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JOINT INTEGRATED AIR DEFENSE SYSTEMS VIEW (J-IADS-VIEW)

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

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This report has been reviewed by the Air Force Research Laboratory, Information Directorate, Public Affairs Office (IFOIPA) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be releasable to the general public, including foreign nations.

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13. ABSTRACT ***(Maximum 200 Words)***

There is a lack of tools to enable the National Air Space and Intelligence Center (NASIC) and their clients to visualize foreign Integrated Air Defense Systems (IADS) information. Current methods to disseminate IADS analysis are manual in nature and time intensive to produce meaningful reports. Analysts conduct foreign country studies to efficiently portray many aspects of foreign IADS. To expand the capability to disseminate critical IADS threat information in a quick and efficient manner, the Joint Integrated Air Defense System View (J-IADS-View) was developed over a two year span. J-IADS-View is an automated computer program that equips the information operations analyst with a tool to create dynamic and animated visual of foreign threat IADS information. J-IADS-View can be used for multiple tasks like pilot training and playback capability, report generation and dissemination, preparation of briefing slides and presentations. J-IADS-View allows the analysts to add audio tracks to their products. It includes the capability to edit scenes and refine them with the analyst's creativity to shape the final product.

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1 J-IADS-VIEW Background

This Task focus is on developing visual means to present foreign threat Integrated Air Defense Systems (IADS) information to NASIC/GTI clients. Products generated using J-IADS-VIEW will be used in conjunction with dynamically rendered IADS country studies to efficiently portray many aspects of foreign IADS. This effort will also lay groundwork for a follow-on visualization task expanding the capabilities of J-IADS-VIEW. The IADS Division is the executive agent for the DoD IADS Support Program (DoDISP) chaired by DIA. This office handles the day-to-day operation of this program which produces country specific studies of threat integrated air defense systems. These all source studies incorporate all aspects of an IADS to include sensors, weapons systems, C3, tactics, doctrine, and overall capabilities of foreign IADS. NASIC/GTI works in conjunction with analysts throughout the community from DIA, CIA, MSIC, NGIC, NASIC, ONI, MCIA, CENTCOM, PACOM, EUCOM, SOUTHCOM, STRATCOM, JWAC, JIOC, AIA, and the FAA to produce these studies.

The hardware for this project is located at the National Air Intelligence Center at Wright Patterson Air Force Base, Ohio on a secure network. The software environment is the standard NAIC computing environment in conjunction with the IADS FLAMES based IADS modeling & simulation tools. The USAF Rome Labs developed JView or an equivalent product API will also play a key role in the software environment.

The SAIC technical point of contact for this task is Michael Sutton, suttonm@saic.com, (937) 431-2273.

2 PURPOSE

The purpose of this document is to summarize certain technical aspects of the J-IADS-VEIW Phase III implementation.

3 JVIEW 1.3 INTEGRATION

The following problems were encountered when upgrading from JView release 1.2 to release 1.3:

1. The Solid Font class did not render text.

   This was fixed by adding an inner class to handle the rendering.

2. The symbol file on a player cube rendered slightly different. The symbol was displayed on a white background instead of a black background.

   The JView developers provided a solution for changing the blending so that a black background was seen.

3. The country name rendered in a different size and color.

   The country name scene element utilized the TextRaster class. The country name scene element was changed to utilize the SolidFont class.

4. The legend stack menu of scenes 1, 2, and 8 did not update properly in the scene panel when the display depth was decreased.

   This proved to be a bug in JView. The JView developers issued a patch.

4 MOVIE SIZE ESTIMATE – CREATE MOVIE

The movie size estimate is calculated as:

(numFrames * frameSizeRaw) / frameCompressionFactor

The number of frames is given by the total scene time and the frame rate. The raw frame size is a constant and is the size, in bytes, of a captured uncompressed frame. The frame compression factor is a constant for each scene and each quality factor and is the ratio of the size of the raw frame to the size of the compressed (jpg) frame. The frame compression factor was determined, for a given scene and quality factor, by averaging all frame sizes over varying total scene time.

All movie size estimate data and calculations are encapsulated within the MovieSizeJPEG class.

Note – the compression factors were based upon a scene area with dimensions 700 x 425. If this is changed, then the factors must be redetermined.

5 MOVIE SIZE ESTIMATE – EXPORT

The export movie size is estimated by applying in succession, the effect of the quality factor, the effect of a reduction in frame size, the effect of a reduction in frame rate, and the effect of the output format.

The effect of the quality factor is calculated as:

sizeEst = sizeOrig * reductionFactor

The reduction factor is a function of the original quality factor and the new quality factor and is calculated as the average of sizeNew / sizeOrig over varying movies and quality factors.

All quality factor movie size estimate data and calculations are encapsulated within the MovieSizeJPEG class.

The effect of a reduction in frame size is calculated as:

sizeEst = sizeOrig * reductionFactor

The original size used in this equation is the estimated size resulting from the effect of the quality factor in the previous equation. The reduction factor is a function of the percentage and is calculated as the average of sizeNew / sizeOrig over varying movies and percentages. For practical reasons, the reduction factors were only determined at 10% intervals. A linear interpolation is used for the other percentages.

All frame percentage movie size estimate data and calculations are encapsulated within the MovieSizeFrameSize class.

The effect of a reduction in frame rate is calculated as:

sizeEst = sizeOrig * (1.0 / factor)

The original size used in this equation is the estimated size resulting from the effect of the frame size in the previous equation. Factor is calculated as Ceiling(frameRateOrig * frameRateNew).

All frame rate movie size estimate data and calculations are encapsulated within the MovieSizeFrameRate class.

The effect of the export format is calculated as:

sizeEst = sizeOrig * reductionFactor.

The original size used in this equation is the estimated size resulting from the effect of the frame rate in the previous equation. The reduction factor is only applicable when converting from Quicktime to AVI. This factor was determined by averaging sizeNew / sizeOrig over a number of movies.

All frame percentage movie size estimate data and calculations are encapsulated within the MovieSizeFormat class.

This final estimate is what is presented to the user.

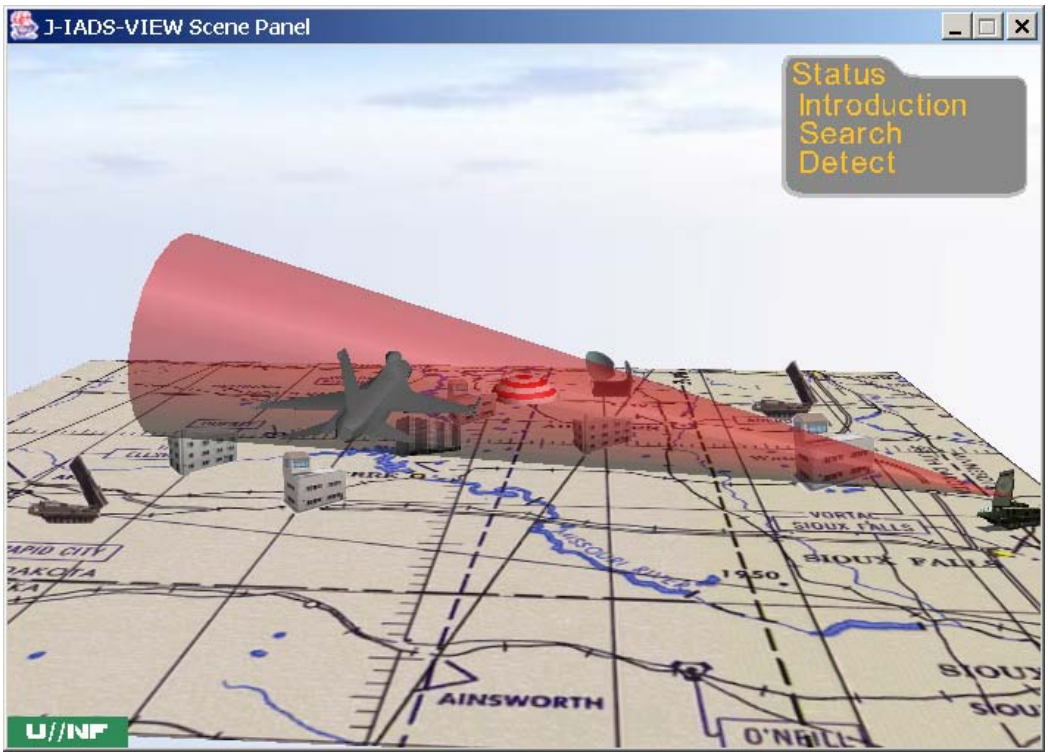
6 SCENE 10 NOTES

Scene 10 (IADS Kill Chain) is the most complicated scene in J-IADS-VIEW. This scene introduced a moving camera. In the other scenes the camera is stationary. The moving camera requires that the classification banner and the status window must be moved and oriented to appear stationary with respect to the camera. The JView Camera3DFixedFollowTool was first tried for this. However, it was discovered that the Camera3DFixedFollowTool was not properly updating its view vector and up vector when moved. Therefore, the computations to place the classification banner and the status window were producing incorrect results. A workaround was achieved by coordinating with the JView development team. The JView development team provided an updated camera tool that properly updated the view vector and up vector. This tool was then massaged into the J-IADS-VIEW software.

Another problem was encountered using the JView RasterImageContainer class. The original coding of this prevented it from being extended. J-IADS-VIEW needed a new anchor type. The JView development team was able to provide the source code for RasterImageContainer which was then renamed to RasterImageContainer3 and incorporated into J-IADS-VIEW.

Several custom scene elements were created for Scene 10. A lightning bolt element was created to show when two players are communicating. A wedge was created to show that a player was interrogating the aircraft for friend or foe status. A search cone and track cone scene elements were created utilizing the JView generic cone element. A raster image scene element was for the player pictures. The status window is a specialized composite scene element that has its background and uses the font class for text. Lastly a scene element was created to hold the camera, thus allow the scene element and the camera to have coordinated movement.

Below is a picture of the IADS Kill Chain Scene during the Detect stage of the animation.



J-IADS-View Scenes 1

7 ACRONYMS, DEFINITIONS AND ABBREVIATIONS

IADS	Integrated Air Defense System
JPG	Joint Photographic Experts Group
NASIC	National Air and Space Intelligence Center